

Study on Host Preference of Lac Insect Species Existing in Manipur

Kshetrimayum Jabaskumar Singh*, Kh. Ibohal Singh, S.M. Haldhar, N. Okendro Singh, and Ngangom Rustom

Department of Entomology, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

*Corresponding author: jabaskumarmeitei@gmail.com (ORCID ID: 0000-0002-5799-1082)

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ABSTRACT

Lac insect, *Kerria lacca* kerr. is a boon of nature to mankind. Lac insect is of economic importance as it produces resin, wax and dye and its productivity, quality and quantity depends on the hosts on which it is cultivated. The investigation was carried out in the completely randomized block design with five hosts replicated three times to study the host preference of lac insect species existing in Manipur under greenhouse condition during *katki* season of 2019-20. The mean initial density of first instar nymph on hosts varied in different portions of hosts which ranged between 10-19, 10-20, 9-23 (crawlers per cm²) with the mean percentage of initial mortality 10-19%, 10-20%, 9-23% (per cm²). The mean final density of first instar nymph ranged between 94-115, 94-115 and 93-114 (crawlers per cm²). The density at maturity of female insects ranged between 2 -8, 2-9, 3-11 (cells per cm²). The mean weight of cell ranged from 8-24, 9-24, 8-23 (mg). The mean fecundity of insect ranged from 188-327, 197-317, 188-316 (eggs per cell). The mean scrapped lac yield ranged between 62-173, 66-170, 59-165 (g) respectively on upper, middle and lower portion. Based on the present investigation *Flemingia macrophylla* was found to be the most preferred host in Manipur region during *katki* season.

HIGHLIGHTS

- ① Lac insect is a soft bodied insect belonging to Coccid group of order Homoptera.
- ① *Rangeeni* and *Kusumi* are the two strains of this insect, each of which produces two crops in a year (bi-voltine).
- ① *Flemingia macrophylla* and *Flemingia semialata* are available as wild hosts.

Keywords: Cell weight, Fecundity, *Katki* season, Lac insect, Scrapped lac

Lac insect (*Kerria lacca* Kerr.) is a valuable gift of nature to mankind. Lac is a natural secretion from the female body known since Vedic period. Lac, popularly known as shellac, in its refined flake form, is the resinous substances secreted as a protective covering by a minute lac insect, *Laccifer lacca*, and (now *K. lacca*). Lac is a minor forest produce and a cash crop is of wide industrial application. Thus it provides economic support to the farmers in rain fed areas and forest dependent people in Madhya Pradesh. Lac cultivation also provides livelihood to 3 - 4 millions of Lac growers. *Kerria lacca* completes its life cycle on host trees

like Palash (*Butea monosperma*), Ber (*Zyziphus mauritiana*), Kusum (*Schleichera oleosa*), Khair (*Acacia catechu*), Babul (*Acacia arabica*), Khatber (*Zyziphus xylophora*), Pigeon-pea (*Cajanus cajan*), Bargad (*Ficus bengalensis*), Peepal (*Ficus religiosa*), besides several trees of regional importance (Barman *et al.* 2006). Lac growers thus give more importance to regular income from cultivation of lac over the years to one-

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time income from timber or fuel. Average net profit from one tree is ₹ 109 for Palash, ₹ 202 to 1060 for Ber and ₹ 1320 for Kusum per crop cycle (Sharma *et al.* 1997). Lac production constitutes a few simple operations that do not require any scientific skills and requires lesser time other than agricultural operations. The pruning of host trees, bundling of brood lac twigs, tying of brood lac on trees for infestation, removal of used up brood lac sticks (phunki) from trees, harvesting of crop and lac scraping are the basic operations in lac production. The operations involved are implemented manually using traditionally available tools and equipments.

MATERIALS AND METHODS

The present study, "Host preference of lac insect species existing in Manipur" was carried out to investigate the preferred host in Manipur region at Department of Entomology, College of Agriculture, Central Agricultural University, Imphal, Manipur. The required broodlac for inoculation to new host was collected from the gene bank of network project on "Conservation of Lac Insect Genetic Resources (NP-CLIGR)" Department of Entomology, College of Agriculture, Central Agricultural University, Imphal.

Experiment details

To study the Host preference of lac insect on different host plants, the following parameters were recorded on twenty plants in five host plants *viz.*, *Cajanus cajan*, *Flemingia macrophylla*, *Flemingia semialata*, *Malvaviscus penduliflorus*, *Calliandra suriamensis* replicated four times in which were sown in pots before the introduction of broodlac to new host during *katki* season of 2019-20 following the standard procedures detailed below.

Observations

(i) Initial density of settlement (crawlers per cm²)

The initial density of settlement was recorded soon after the emergence of first instar nymphs. Where 1 cm² area was select at random and the number of lac crawlers settled on suitable sites was visually counted. Three sites were selected as such (preferably on lower, middle and upper portion of

settlement) from the selected hosts and the average was taken as initial density of settlement.

(ii) Initial mortality (%)

The above processes were repeated in 21-days after inoculation of brood-lac on the new host. The process of larval emergence continues up to 2 weeks after inoculation. The crawlers, which were unable to find suitable sites for their settlement, died due to starvation. Observation at this stage is the true result of the number of larvae actually settled and which have started feeding.

Initial mortality =

$$\frac{\text{Difference between initial density and density on 21 days}}{\text{Initial density}} \times 100$$

(iii) Final density of settlement (number per square cm)

Final density of settlement = Difference between Initial density and Initial mortality

(iv) Density at crop maturity (crawlers per cm²)

The matured female lac insects surviving were counted as above at crop maturity (when yellow spots appear) and was recorded as density at crop maturity (number per cm²).

(v) Weight (mg) of the female cell

The weight of individual female cells was recorded after the larval emergence had completed using electronic balance.

(vi) Fecundity (number crawlers emerged from the female cell)

To observe the fecundity, mature female cells were stored separately into individual glass vials plugged in with cotton for more or less about a month and the total number of emerged crawlers completely were counted as fecundity of the female lac insect either fertilized or not.

(vii) Total yield (g)

The lac sticks harvested were dried and scrapped with knives and the total yield (g) per plant was recorded.



RESULTS AND DISCUSSION

Initial density of settlement (crawlers per cm²)

The mean initial density of first instar crawlers of lac insect observed 80-101, 93-120, 89-112, 80-110 and 87-108 crawlers per cm² on *Cajanus cajan*, *Flemingia macrophylla*, *Flemingia semialata*, *Malva viscus peduliflorus*, *Calliandra suriamensis*, respectively. The results of present study is in agreement with the experimental findings of Mohanta *et al.* (2014) who reported the mean initial density of settlement ranging between 92.58 and 126.74 crawlers per cm² and 93.12-109.62 crawlers per cm² of *Kusumi* strain on Kusum and Ber respectively.

Initial mortality (%)

The data divulged that the mean percentage of initial mortality varied from 9-21 % mortality per cm² which confabulates with the experimental findings of Kalahal *et al.* (2017) who discovered that the percentage of mortality ranged between 6.46 and 12.57 % of *Rangeeni* strain lac insect in pigeon pea during *Katki* season.

Final density (crawlers per cm²)

The mean final density of settlement of crawlers observed were 74.31, 94.24, 89.48, 82.60 and 84.51 crawlers per cm² respectively on *Cajanus cajan*,

Flemingia macrophylla, *Flemingia semialata*, *Malva viscus penduliflorus* and *Calliandra suriamensis* during *Katki* season, 2019-20. The present data confabulates with the experimental finding of Kalahal *et al.* (2017) who revealed that the mean final density of first instar crawlers ranged between 17 to 114 crawlers per cm² of *Rangeeni* strain of lac insect in pigeon pea during *Katki* season.

Density at crop maturity (per cm²)

The present study disclosed that the highest density of cells at maturity observed was 8.54 female cells per cm² on *F. macrophylla* whereas the lowest density observed was 3.23 female cells per cm² in pigeon pea of *Rangeeni* strain of lac insect in *katki* season, 2019-20. The results of present observation are in confabulation with the experimental findings of Mohanta *et al.* (2014), who also discovered average higher density of female cells at crop maturity as 3.38-12.67 cells per cm² on palas for *Rangeeni* strain of lac insect.

Weight of cell (mg)

The mean female cell weight discovered from present study was respectively 10.15, 21.49, 17.74, 11.36 and 14.61 mg during *Katki* season, 2019-20. The results of present study are in agreement with the experimental discovery of Mishra *et al.* (1999)

Table 1: Initial density of settlement (number per sq. cm) of *Rangeeni* strain lac insect species existing in Manipur

Hosts	Upper portion	Middle portion	Lower portion	Mean
<i>Cajanus cajan</i>	96.35	99.12	95.43	96.97
<i>Flemingia macrophylla</i>	112.26	113.65	112.75	112.89
<i>Flemingia semilata</i>	109.69	108.25	107.8	108.58
<i>Malva viscus penduliflorus</i>	99.92	101.64	98.21	99.92
<i>Calliandra suriamensis</i>	105.23	106.64	104.4	105.42
SE (d)	1.25	0.98	1.09	1.119
CD (5%)	2.69	2.10	2.34	2.525

SE(d) – Standard error of difference; CD – Critical difference.

Table 2: Initial mortality (percentage per sq cm) of *Rangeeni* strain lac insect species existing in Manipur

Hosts	Upper portion	Middle portion	Lower portion	Mean
<i>Cajanus cajan</i>	19.12	18.98	20.58	19.56
<i>Flemingia macrophylla</i>	11.23	10.86	13.14	11.74
<i>Flemingia semilata</i>	14.25	13.07	15.03	14.12
<i>Malva viscus penduliflorus</i>	16.59	15.42	17.72	16.58
<i>Calliandra suriamensis</i>	15.21	15.15	17.32	15.89
SE (d)	0.70	0.50	0.57	0.90
CD (5%)	1.51	1.07	1.23	2.01

SE(d) – Standard error of difference; CD – Critical difference.

Table 3: Final Density of settlement (number per sq cm) of *Rangeeni* strain lac insect species existing in Manipur

Hosts	Upper portion	Middle portion	Lower portion	Mean
<i>Cajanus cajan</i>	73.85	74.76	76.90	148.61
<i>Flemingia macrophylla</i>	92.72	95.98	94.01	188.70
<i>Flemingia semilata</i>	91.66	89.45	87.33	181.11
<i>Malva viscus penduliflorus</i>	82.89	83.19	81.71	166.08
<i>Calliandra suriamensis</i>	85.68	83.22	84.64	168.90
SE (d)	1.00	0.60	0.72	1.26
CD (5%)	2.14	1.30	1.55	2.82

SE(d) – Standard error of difference; CD – Critical difference.

Table 4: Density at crop maturity (number per sq cm) of *Rangeeni* strain lac insect species existing in Manipur

Hosts	Upper portion	Middle portion	Lower portion	Mean
<i>Cajanus cajan</i>	3.23	3.56	2.03	2.94
<i>Flemingia macrophylla</i>	7.68	8.54	7.32	7.85
<i>Flemingia semilata</i>	6.42	6.96	5.25	6.21
<i>Malva viscus penduliflorus</i>	4.75	4.36	4.82	4.64
<i>Calliandra suriamensis</i>	6.24	5.81	5.68	5.91
SE (d)	0.82	0.59	0.50	0.51
CD (5%)	1.77	1.26	1.08	1.14

SE(d) – Standard error of difference; CD – Critical difference.

Table 5: Weight of female cell (mg) of *Rangeeni* strain lac insect species existing in Manipur

Hosts	Upper portion	Middle portion	Lower portion	Mean
<i>Cajanus cajan</i>	9.92	10.88	9.65	30.45
<i>Flemingia macrophylla</i>	21.72	21.85	20.91	64.48
<i>Flemingia semilata</i>	17.52	18.25	17.44	53.21
<i>Malva viscus penduliflorus</i>	11.60	11.65	10.82	34.07
<i>Calliandra suriamensis</i>	14.92	14.20	14.72	43.84
SE (d)	1.16	0.19	1.01	1.28
CD (5%)	2.49	1.96	2.17	2.85

SE(d) – Standard error of difference; CD – Critical difference.

Table 6: Fecundity of female insect (number per cell) of *Rangeeni* strain lac insect species existing in Manipur

Hosts	Upper portion	Middle portion	Lower portion	Mean
<i>Cajanus cajan</i>	189.55	198.38	190.43	192.79
<i>Flemingia macrophylla</i>	325.56	315.68	314.03	318.42
<i>Flemingia semilata</i>	289.36	290.56	292.02	290.65
<i>Malva viscus penduliflorus</i>	221.65	251.87	280.65	251.39
<i>Calliandra suriamensis</i>	215.42	221.78	202.56	213.25
SE (d)	0.89	0.96	1.17	11.72
CD (5%)	1.91	2.06	2.52	26.12

SE(d) – Standard error of difference; CD – Critical difference.

Table 7: Yield of scrapped lac (g) of *Rangeeni* strain lac insect species existing in Manipur

Hosts	Upper portion	Middle portion	Lower portion	Mean
<i>Cajanus cajan</i>	63.95	68.02	61.23	64.40
<i>Flemingia macrophylla</i>	170.62	167.35	162.56	164.96
<i>Flemingia semilata</i>	160.89	156.32	150.12	155.78
<i>Malva viscus penduliflorus</i>	90.89	87.2	81.78	86.62
<i>Calliandra suriamensis</i>	137.23	130.4	132.32	133.32
SE (d)	1.15	1.42	1.11	3.48
CD (5%)	2.47	3.05	2.39	7.75

SE(d) – Standard error of difference; CD – Critical difference.

who also assessed the productivity of Indian lac insect on *F. semialata* and *F. macrophylla* in terms of the dry cell weight and reported 8-19 mg and 9-18.83 mg on mentioned hosts respectively. The present discoveries are in equivalence with the experimental reports of Kumar *et al.* (2007) who assessed 7 host plants with reference to the cell weight and discovered that it ranged between 9.40- to 13.60 mg in pigeon pea and 10.12 to 14.21 mg in ber in Baisakhi season.

Fecundity of female insects (number of crawlers)

The mean fecundity found maximum with 325.56 for *F. macrophylla* while minimum 198.38 crawlers found emerged per cell in pigeon pea. The results of present experiment gets support from the experimental findings of Kong *et al.* (1984), who revealed that the reproduction potential of *Kerria lacca* ranged between 224 to 307 eggs in 1st generation and 160 to 240 eggs in 2nd generation.

Total yield of scrapped-lac (g)

The present study reveals that the mean scrapped lac yield were 64.40, 164.96, 155.78, 88.62 and 133.32 respectively on *Cajanus cajan*, *Flemingia macrophylla*, *Flemingia semialata*, *Malvaviscus penduliflorus* and *Calliandra suriamensis* during Katki season, 2019-20. The similar study was conducted by Divakara (2013) who discovered scrapped lac yield per host as 166.64g in winter and 81.47g during katki season however Kalahal *et al.* (2017) reported that the yield of scrapped lac was 15.63 gm. of Rangeeni strain of lac insect in Pigeon pea.

CONCLUSION

The present study showed that *Flemingia macrophylla* is the most preferred host of lac insect species existing in Manipur i.e., *Kerria manipurensis* Ahmad *et al.* (2012) by comparing the means using least significant difference (LSD) test during Katki season of 2019-20.

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